north—as a drift with the currents. The negative fact that none of the smaller larvæ have appeared north of the Azores, and none of the larger ones south, seems to favour such an explanation. The further fact that none of the transformation stages, previously found so abundantly on the continental slope, were found in mid-ocean supports the same view. Nevertheless, I consider it dangerous to form any definite opinion from negative facts concerning such vast ocean expanses, where so few investigations have as yet been made.

As a provisional working hypothesis I should be inclined to regard the continental slope as the area where the transformation of the larvæ takes place, and the southern central part of the North Atlantic ocean as the probable spawning area of the eel.

Fig. 5 gives information as to the depths at which the *Michael Sars* caught the eel-larvæ. The youngest specimens were mainly found by towing a net with 100 metres

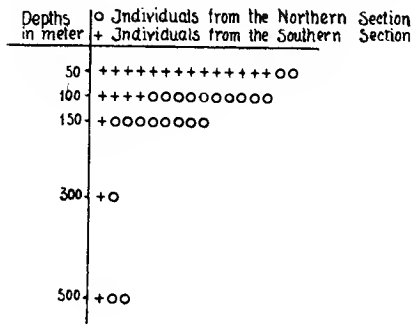

FIG. 5.

of wire out, or in a depth of about 50 metres. The eldest stages were found in nets towed with 200 metres of wire out, or at a depth of about 100 metres. The *Michael Sars* employed for these depths mostly silk nets with mouths of 1 m. in diameter, and no trawls. Otherwise larger catches of eel-larvæ might have been procured. I should recommend that future investigators look for the eggs and the smallest larvæ from the surface down to 100 metres, say between the Azores and Bermudas, in winter. I hope that this information will in this way be found useful.

JOHAN HJORT.

Bergen, November 7.

Are Mules Fertile?

IN the *Nuevo Mundo* of Madrid for October 27 it is stated that a mule, belonging to Don Carlos Gimenez, of Argamasella de Calatrava, recently gave birth to a foal. From India, South Africa, and America reports have reached the writer about fertile mules, but in no single instance has the evidence of fertility been altogether satisfactory. In the present case the information thus far submitted is very meagre. Nothing is said about the breeding of the reputed parent of the foal. She may be a she-ass with the conformation of a mule, or a mule in milk which succeeded in stealing a mule foal from a mare. A Przewalsky-horse hybrid bred at Penycuik proved fertile, but all the ass and zebra hybrids experimented with during the last twelve years proved sterile. The male zebra-horse hybrids were sterile because they never succeeded in maturing perfect sperms. The hybrid "Romulus," *e.g.*, had all the instincts of a pony stallion, and, so far as one could judge with the naked eye, he was capable of getting foals. When, however, a microscopic examination was made, it was ascertained that the sperms were quite or almost tailless—at the most the length of the flagellum was never more than three or four times the diameter of the head, and it was immobile. Why female mules are infertile has not yet been determined.

Sterility in birds seems sometimes to be due to structural changes in the germ cells induced by in-and-in-breeding. It is conceivable that similar changes may sometimes result from intercrossing. It must be admitted that the photograph reproduced in the *Nuevo Mundo* supports the view that the Calatrava foal is a mule, and that the reputed mother is also a mule.

But further and more definite information is wanted before a decision can be arrived at.

J. C. EWART.

The Origin of Dun Horses.

THE cases quoted by Prof. Cossar Ewart from Mr. J. B. Robertson in NATURE of November 10 would be good evidence against the theory that every dun horse must have at least one parent dun or grey if the data in the Thoroughbred Stud-book were absolutely trustworthy. This they are not, and all the cases quoted by Prof. Ewart have in them a very considerable element of doubt. Let me indicate these elements by placing the cases quoted in one column, in reversed chronological order, and the necessary remarks in another column parallel.

Cases Quoted.	*Remarks.*
Bay-dun filly, foaled 1907, dam, Unexpected.	This filly is registered "b. or dun."
Dun colt, foaled 1897, dam, Lobelia.	This colt is registered "b. or dun."
Dun filly, Sarah Curran, foaled 1892, dam, Cellulites.	In vol. xvii. Cellulites' foal of 1892 was said to have died, but in vol. xviii. the alleged dead foal becomes Sarah Curran.
Light dun filly, foaled 1886, dam, Danseuse.	This filly is registered "bay."
Dun or chestnut filly, Saneta, foaled 1884.	The breeder had doubts as to this filly's colour.
Dun filly, foaled 1829, dam, Octavia.	This filly died when two days old.
Dun filly, foaled 1763, dam, Miss Thigh.	This filly had eight foals the colours of which were registered, and not one was dun.
Dun colt, foaled 1730, dam, Young Kitty Burdett.	This colt's sire was grey.

The last case quoted is the mare Silverlocks, from which nearly all the duns in the Stud-book are descended. Silverlocks is credited with five foals, the first of which was foaled in 1738, and four of these were dun. Three of these four were by a bay or brown horse. So Silverlocks herself was presumably a dun. The Stud-book assumes that this mare Silverlocks was identical with a chestnut mare Silverlocks foaled in 1825. Either the 1825 Silverlocks was a dun, not a chestnut, or the two mares were different animals.

JAMES WILSON.

Royal College of Science, Dublin, November 15.

The Cocos-Keeling Atoll.

IN stating the depths to which the bores in the Funafuti lagoon were carried, and in drawing his deductions from them, the reviewer (NATURE, November 10) has fallen into a very curious error. He states that the first bore was driven to a depth of 41 fathoms, and the second to nearly 36 fathoms, but he overlooks the fact that he is giving the measurements from the surface of the lagoon water, and not from the lagoon floor.

The bores were started in 101 feet of water at low-water spring tide, and therefore, of the 41 and 36 fathoms mentioned by the reviewer, the top 17 fathoms in each case consist of nothing but lagoon water. The actual bores made into the lagoon bed penetrated no more than 24 and 19 fathoms respectively, or, as I pointed out in my last communication, a maximum of 144 feet.

F. WOOD-JONES.

MY depths of 41 and 36 fathoms were not intended in any way as a correction of Mr. Wood-Jones's letter. The important point is that lagoon débris *only* occurred above 27 fathoms; there was 10 fathoms of it. Below this depth we get coral rock.

It is a long time since any discussion has been held in this country on coral-reef formation, while much work

has been done during the last decade. I suggest that a public discussion, such as that on "The Origin of Vertebrates," held at the Linnean Society last session, would be valuable. THE REVIEWER.

IN our work in Challenger Office in connection with deep-sea deposits, we are very much impressed with the fact that solution of calcium carbonate is going on in the ocean, not only at great depths, but at all depths from the surface to the bottom wherever dead organisms which secrete carbonate of lime are exposed to the action of the sea water, as was recognised and insisted on by Semper, Murray, Agassiz, and others. We are therefore much interested in the discussion going on in NATURE regarding solution in the lagoons of atolls.

Mr. Wood-Jones considers that there are no actual proofs of solution in the lagoons of atolls, but, at the same time, admits the deposition of calcium carbonate.

The quantity of calcium carbonate present in solution in normal sea water is very small—only 0·12 gram per litre for water of specific gravity 1·026—and *no* precipitate is obtained on allowing it to stand for any length of time. When, however, sea water has remained for some period in contact with calcium carbonate it may take up a greater amount (up to 0·649 gram per litre). The solution is then supersaturated, and, on being allowed to stand, calcium carbonate is deposited in the crystalline form, and the deposition may go on until the solution contains less than is normally present in sea water.

The first condition, therefore, for precipitation is that *more* calcium carbonate than is normally present should pass into solution, and this can only occur when the sea water is in contact with a calcareous deposit for some time.

Would Mr. Wood-Jones say where the calcium carbonate which is precipitated in the crystalline form in the interstices of the massive corals in the lagoons comes from, for it is certainly not from the normal sea water which reaches the reefs from the open ocean?

It would appear that Mr. Wood-Jones's arguments against Sir John Murray's theory go rather in support of it. MADGE W. DRUMMOND.

Challenger Office, Villa Medusa, Boswell Road, Edinburgh, November 17.

The Flight of Birds against the Wind.

IN an interesting article (NATURE, November 10) upon bird migration and Mr. Power's recently published "Ornithological Notes," Sir T. Digby Pigott expresses surprise at the latter's conclusions that in the large autumnal migrations the birds invariably fly "almost directly against the wind even when it approaches a stiff breeze."

My observations on the flight of gulls during south-west gales off this coast lead to the conclusion that these birds during their aërial gyrations either face the wind or fly obliquely across the current. They very rarely fly, and, I believe, never soar, with the wind behind them. Perhaps less muscular energy is necessary in the former than in the latter case. Fish in rapid rivers, when not actively moving, according to my experience remain with their heads upstream. W. AINSLIE HOLLIS.

Hove, November 15.

THE ACCURATE MACGILLIVRAY, ORNITHOLOGIST.[1]

"THE accurate MacGillivray" is Darwin's designation of the subject of this notice, and "ornithologist" is the title which, when twenty-three years of age, he himself presaging his own powers, declared it would go hard with him if he did not merit.

Who MacGillivray was does not require to be told to the ornithologist conversant with the literature of his subject; but the general reader and the superficial bird-man have probably never heard his name. Yet that he was "the greatest and most original ornithological genius save one . . that this island has produced," is the verdict of so distinguished an ornithologist of our day as Newton. Why MacGillivray's biography should have tarried until his ashes had been fifty-eight years in the tomb is hard to understand, except probably that, born before his time, his contemporaries failed to perceive the genius of the man, or realise the pioneer he was.

William MacGillivray, born in Aberdeen in 1796, was the son of a military surgeon who died on the field of Corunna. The story of his self-denying life is that of not a few Scottish students, who, scantily provided with means, have yet by their indomitable will-power and love of learning achieved distinction, honour, and lasting fame. The future ornithologist's boyhood, from the age of three, was spent in Harris, in the Hebrides, where nature is wild and presents herself in many changing and impressive aspects. In the parish school a few miles from his home, he obtained, "under dull scholastic rule," a good elementary education, but his chief and unconscious preceptors were "the solitudes of nature" and "the moaning voice of streams and winds." At the age of eleven he set out for Aberdeen, to prepare, under more advanced tutors, for his entrance the following year into the University there, with a view to his father's profession. He probably on this occasion, as he invariably did at the beginning and end of the various college sessions, walked all the way athwart Scotland from his landing place on the west coast. When twelve years old he entered King's College, at that time the University of old Aberdeen (as then known), which (until 1860) was distinct from Marischal College, the University (junior by a century) of new Aberdeen. Having graduated M.A., when four years older, he proceeded at once to the study of medicine, of which one of the courses was botany, and with it, as he has recorded, he first began the study of nature "which has been particularly fascinating." A year later he took up zoology. His vacations were thenceforth spent in pedestrian excursions over the Highlands and islands, collecting plants and animals, keenly observing and carefully recording every aspect of nature.

It was during this period that MacGillivray acquired his great dexterity with the scalpel, and became so accomplished an anatomist that he was appointed dissector to the lecturer on anatomy in Marischal College. Unable, however, to resist the call of natural history, he relinquished this not uncongenial post in order to devote himself exclusively to his mistress. As one of the means to "further his cognition of these things," he set out on foot from Aberdeen for London *via* Fortwilliam and Ben Nevis—hardly the direct route—to visit the British and other Metropolitan museums, and observe life by the way. Drenched or dry, tired or otherwise, he never neglected at the close of the day to record fully in his journal the valuable notes he had made. After an 837 mile tramp, full of extraordinary experiences, he reached the capital, "satisfied," as he says, "with my conduct"; and not unjustly so, for his expedition had gone far to mature the youthful enthusiast. His study of the various zoological collections in London convinced him that the methods of classification of modern ornithologists were such as he could not accept. Before he returned to Aberdeen he had formed the resolve "to become the author of a new system," which formed the aim of his life thenceforward. In 1819 or 1820, MacGillivray migrated from Aberdeen to Edinburgh, and as he had recently married, it

[1] "Life of William MacGillivray, M.A., LL.D., F.R.S.E., Ornithologist Professor of Natural History, Marischal College and University, Aberdeen. By William MacGillivray, W.S. With a Scientific Appreciation by Prof. J. Arthur Thomson. Pp. xv+222. (London: John Murray, 1910.) Price 10s. 6d. net.